

The Impacts of Microphysics and Planetary Boundary Layer Physics on Model Simulations of U. S. Deep South Summer Convection
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---abstract text---

Inspection of output from various configurations of high-resolution, explicit convection forecast models such as the Weather Research and Forecasting (WRF) model indicates significant sensitivity to the choices of model physics parameterizations employed. Some of the largest apparent sensitivities are related to the specifications of the cloud microphysics and planetary boundary layer physics packages. In addition, these sensitivities appear to be especially pronounced for the weakly-sheared, multicell modes of deep convection characteristic of the Deep South of the United States during the boreal summer. Possible ocean-land sensitivities also argue for further examination of the impacts of using unique ocean-land surface initialization datasets provided by the NASA Short-term Prediction Research and Transition (SPoRT) Center to select NOAA/NWS weather forecast offices.

To obtain better quantitative understanding of these sensitivities and also to determine the utility of the ocean-land initialization data, we have executed matrices of regional WRF forecasts for selected convective events near Mobile, AL (MOB), and Houston, TX (HGX). The matrices consist of identically initialized WRF 24-h forecasts using any of eight microphysics choices and any of three planetary boundary layer choices. The resulting 24 simulations performed for each event within either the MOB or HGX regions are then compared to identify the sensitivities of various convective storm metrics to the physics choices. Particular emphasis is placed on sensitivities of precipitation timing, intensity, and coverage, as well as amount and coverage of lightning activity diagnosed from storm kinematics and graupel in the mixed phase layer. The results confirm impressions gleaned from study of the behavior of variously configured WRF runs contained in the ensembles produced each spring at the Center for the Analysis and Prediction of Storms, but with the benefit of more straightforward control of the physics package choices. The design of the experiments thus allows for more direct interpretation of the sensitivities to each possible physics combination. The results should assist forecasters in their efforts to anticipate and correct for possible biases in simulated WRF convection patterns, and help the modeling community refine their model parameterizations.